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The Coal Situation

A quarterly review from Energy Economics — THE CHASE MANHATTAN BANK, N.A. NEW YORK, N.Y. 10081

Vol. 1 — No. 1
JULY, 1980

WORLD COAL OUTLOOK

The contribution of coal to world energy needs, particularly in the western world, may appear to be an engima, given the size of known reserves and the economic, social, and political difficulties that were created by the oil events of 1973-74. In actuality, there is very little mystery surrounding the less than full realization of the post-embargo expectations for coal.

Quite simply, the increased emphasis on coal has brought into sharp focus the conflict between energy and environmental policies. The 1974 oil price increases overcame the inherently higher costs of transporting, storing and burning coal. This economic advantage was substantially moderated by the added costs associated with using it in a manner consistent with environmental legislation and regulations. The net effect was an erosion of the initial high interest in coal. In 1979, the renewed instability and dramatic price increases in world oil markets produced a major change in the social and economic attractiveness of coal. Society is now re-examining the trade-offs it is willing to accept between the environment and economic activity. It is more important, however, that the price increases in 1979 and expectations for continued instability in world oil markets have made the environmentally acceptable use of coal affordable. This fact is illustrated in Table 1.

TABLE 1

RELATIVE FOSSIL FUEL COST
FOR LARGE INDUSTRIAL USES

	1978 Relative Costs*	1980 Relative Costs*	1990 Relative Costs*
Coal**	100	100	100
Low Sulfur Fuel Oil	81	107	129
Natural Gas	70	106	125

* includes capital costs, operation and maintenance expenses, and the cost of fuel.

** includes all costs associated with complying with sulfur emission standards, particulate emissions standards, and waste disposal.

Sources: ICF, Inc., and Energy Economics.

Table 1 shows a comparison of the relative cost of new installations for the three fossil fuel alternatives available to a large industrial consumer in the United States. The total costs of each alternative are indexed relative to coal, including all the costs of complying with existing or anticipated environmental standards for sulfur, particulate matter, and waste disposal. The first column indicates the situation faced by the industrial user in 1978. At that time, oil held a 19 percent advantage and natural gas a 30 percent advantage over coal. As a result of the price increases beginning in 1979, coal now enjoys a 7 percent and 6 percent relative advantage over the oil and natural gas options, even with the imposition of environmental control requirements.

Over the long term, environmental issues aside, the cost advantage for coal is expected to widen, as oil and natural gas prices escalate at rates greater than those anticipated for coal. It is possible that the gap between coal and the alternatives shown in the last column of Table 1 will be smaller as the emphasis on further environmental improvements accelerates in response to increased coal use. The overall relative advantage is expected to remain with coal, however, thus leading to its increased replacement of oil or natural gas.

Further supporting the outlook for the increased consumption of coal is the growing level of concern surrounding the nuclear option for electric power generation. Even before the Three Mile Island incident some felt that technical, social, and political difficulties such as proliferation and nuclear waste disposal were making the nuclear option less attractive. Three Mile Island served to emphasize the areas of safety and financial risk.

The effects on coal have been two-fold. First, current consumption and future demand have increased because of the more intensive use of existing coal-fired units and the replacement of planned nuclear capacity with new coal-fired generation. Thus, coal has directly benefited from the downward revision of plans for nuclear capacity expansion. But this downward revision has not led to a one-for-one increase in planned coal-fired capacity, which leads to the second point. Some of the reduction in nuclear capacity plans is of course due to the new lower forecasts of electricity demands. Thus, some of the nuclear capacity reduction will not be replaced by coal, at least not on the same schedule. In fact, new coal-fired units

are not immune to the effects of lower growth in electrical demands. Overall, however, coal demand will be higher because of problems facing nuclear power generation.

Finally, there is potential for a major new use of coal as a feedstock in the synthetic production of gaseous and liquid energy products. Although there has been a marked improvement in the relative attractiveness of using coal in this application, key uncertainties are expected to retard its early widespread use. The major uncertainty pertains to the cost estimates of the coal-use facilities relative to the future cost and availability of alternative sources of the same or similar products.

Currently, these uncertainties imply a need for government support in the form of direct subsidy and/or guarantees in order to launch a synthetic fuels industry in a timely fashion. In the United States such actions are being pursued although they will not produce meaningful results until 1985 and beyond because of the lead times required. Regardless of the future of coal-based synthetics, the coal industry is expected to grow rapidly, principally in response to the needs for direct thermal or steam applications in the industrial and utility sectors.

Figure 1 shows the historical and forecasted world coal consumption for the period 1973 through 1990. Plotted separately are coal's two general market applications, steam (thermal) and metallurgical (coking) coal. As shown, steam coal is expected to be the fastest growing market application, with total consumption increasing by more than 2 billion tons over the 1978 level of 3.2 billion tons. In terms of rates of growth, steam coal demands are expected to increase an average of 4.4 percent per year between 1978 and 1990, versus an historical rate of 3.2 percent per year between 1973 and 1978.

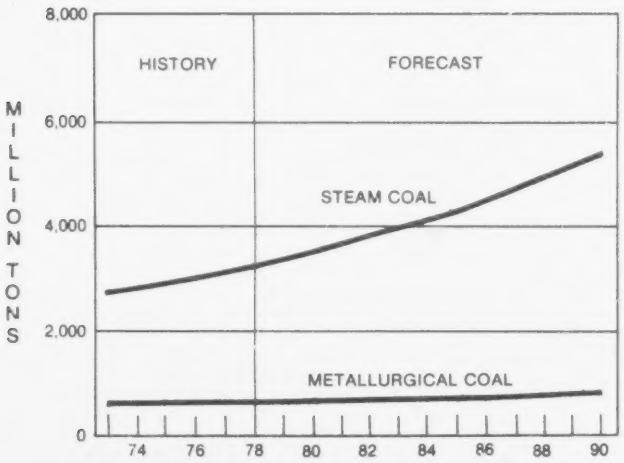
Between 1978 and 1990, the worldwide consumption of metallurgical coal is expected to grow relatively slowly at an average rate of only 2.3 percent per year. The softness of the metallurgical coal sector reflects slower steel industry expansion in response to lower economic activity, changing steelmaking technologies, and substitution effects such as the trend to smaller and lighter automobiles and the trend to less energy-intensive or energy-saving materials.

Although coal's future is bright, its future rate of growth is still quite uncertain. In particular, demand growth in the steam coal market sector is uncertain due to three important factors: environmental concerns, the level of nuclear expansion and electricity demands, and infrastructural expansion needed to support coal production, transportation, and use.

The effects of varying the assumptions in these areas are illustrated in the graph of Free World steam coal demands through 1990 shown in Figure 2. As the figure shows, the uncertainties suggest greater downside risk than upside potential. The pessimistic forecast for 1990 shows demand 365 million tons lower than the best estimate projection, while the optimistic forecast is not quite 180 million tons greater. Even under the pessimistic scenario, however, higher oil and natural gas prices and lower nuclear expansion produce a rate of growth higher than recent history. Under the pessimistic scenario, coal usage is expected to expand at an average annual rate of 3.5 percent per year between 1978 and 1990. Growth between 1973-78 averaged 2.8 per year, while consumption during the 5-year period prior to the oil embargo of 1973-74 *declined* by an average of 0.2 percent per year.

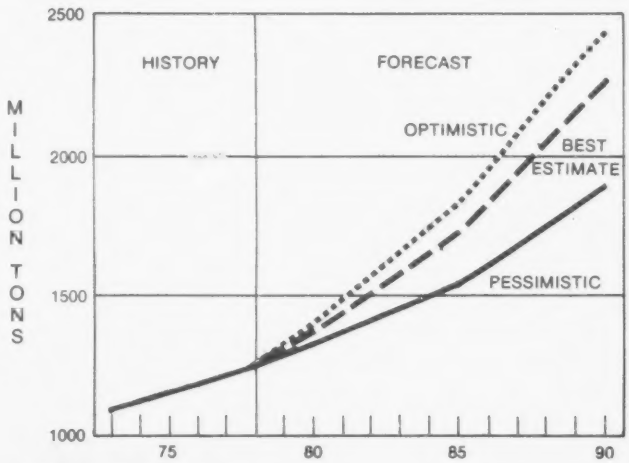
The increase in world coal consumption will bring with it a rapid expansion in international coal trade. The level of net trade is expected to almost

Figure 1
World Coal Consumption 1973-1990



Source: Energy Economics

Figure 2
Uncertainty Surrounding Free World Steam Coal Consumption 1973-1990



Source: Energy Economics

double, reaching 356 million short tons by 1990 versus 136 million tons traded in 1978. As is the case in total consumption, steam coal is expected to be the most rapidly expanding portion of the international market for coal. In 1978, steam coal represented 36 percent of the total level of net coal trade. By 1990, steam coal trade is expected to account for 52 percent of the coal moved internationally. Electric power generation will be the largest end-use application as oil-importing nations pursue the replacement of existing oil-fired power plants and respond to growth in electricity demand.

Table 2 shows the actual 1978 and forecasted 1990 levels of net imports for steam and metallurgical coal in the major market areas of the world. As indicated, Europe is expected to remain the largest single market outlet for steam coal, with net imports reaching 135 million tons per year by 1990 versus 36 million tons in 1978. The Asian market, led by Japan, Taiwan and South Korea, is expected to show the highest rate of growth through the forecast period. By 1990, the Asian net imports are expected to show an almost 10 fold increase over the 4 million tons imported in 1978.

TABLE 2

MAJOR NET IMPORTERS

(Million Short Tons)

	Steam Coal		Metallurgical Coal	
	1978	1990	1978	1990
Europe	36	135	24	49
Asia	4	39	59	79
Other	9	12	4	42
Total	49	186	87	170

Source: Energy Economics

In the case of metallurgical coal, Asia, principally Japan, is expected to remain the largest market outlet, accounting for 79 million tons by 1990. With imports of 49 million tons in 1990, Europe remains the second largest market for international metallurgical coal supplies. "Other" markets, however, show the largest rate of growth. Planned expansion of the Latin American steel industry accounts for the majority of the forecasted imports in this segment of the market.

In supplying coal to the international markets, South Africa is expected to continue its domination of the steam coal sector while the United States and Australia are the dominant net suppliers of metallurgical coal. Table 3 shows the actual 1978 and forecasted 1990 levels of trade for the major net exporters of coal. As is indicated, South African steam coal exports are 80 million tons in 1990, which would be more than double that of its closest rival. This situation not only reflects South Africa's competitive advantage in mining costs, but also, and more importantly, its transportation advantages in getting the coal from the mine to the final user. The United States and Australia, as a result of their endowment of metallurgical grade coal resources and their capabilities to meet a growing market will continue to dominate this sector. Both are expected to almost double their exports of metallurgical coal, with each supplying 70 million tons by 1990.

TABLE 3

MAJOR NET EXPORTERS

(Million Short Tons)

	Steam Coal		Metallurgical Coal	
	1978	1990	1978	1990
United States	8	30	30	70
South Africa	15	80	2	3
Australia	6	35	37	70
Other	20	41	18	27
Total	49	186	87	170

Source: Energy Economics

In summary, although the future is not without uncertainty, the outlook for coal demand is encouraging. The paramount concern in coal's future will continue to be the impact of its usage on the world's environment. In particular there will be the growing concern over acid rain and carbon dioxide build-ups. Nevertheless, the reaffirmation in 1979 of the economic, social, and political costs of the world's continued over-dependence on oil makes it more likely that these environmental problems will be dealt with on an overall cost/benefit basis.

The world coal industry faces a future of opportunity and challenge: opportunity of growing markets and the challenge to respond. The next issue of *The Coal Situation* will examine the capital needed to support the anticipated growth of the world's coal industry.

Vincent J. Calarco, Jr.

IMPORTANT NOTICE

This is the first issue of Energy Economics' **Coal Situation. The Coal Situation** joins its sister publication, The Petroleum Situation, as a brief, periodic review of an important energy field.

The Coal Situation will be published quarterly, and is free of charge. The contents of each issue will include a lead article providing The Chase Manhattan Bank assessment of a significant element of the coal energy sector, such as this issue's "World Coal Outlook," as well as highlights and statistical tables of the world coal market's performance.

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UNITED STATES COAL BALANCES

	JANUARY THRU MARCH 1980	1979	CHANGE
	Million Short Tons		-%-
Consumption			
Electric Utilities	144.57	130.57	10.72
Coke Plants	18.78	19.28	-2.59
General Industry	19.39*	17.96	7.96
Retail Deliveries	3.08*	2.87	7.32
Total Domestic Demand	185.82*	170.68	8.87
Exports	14.13	10.97	28.81
Total Demand	199.95*	181.66	10.07
Supply			
Domestic Production	197.16	176.88	11.47
Imports	0.41	0.56	-26.79
Total New Supply	197.56	177.44	11.34
Stock Change	-2.39	-4.21	–

Totals may not add due to rounding
*Estimated

Sources: U.S. Department of Energy
National Coal Association
Chase Manhattan Bank

EUROPEAN ECONOMIC COMMUNITY COAL BALANCES – HARD COAL

	JANUARY THRU MARCH 1980	1979	CHANGE
	Million Short Tons		-%-
Deliveries to:			
Power Stations	53.56*	42.82	25.08
Coke Plants	24.89*	23.46	6.10
General Industry	6.63*	6.38	3.92
Households & Miners' Coal	5.73*	5.84	-1.88
Total Domestic Demand	90.81*	78.50	15.68
Exports	0.37	0.77	-47.05
Total Demand	91.18	79.27	15.02
Supply			
Domestic Production	84.87	71.09	19.38
Imports (third-party countries)	18.02	12.67	42.23
Total New Supply	102.89	83.76	22.84
Stock Change	11.71	4.49	–

Totals may not add due to rounding
*Estimated

Sources: Eurostat
Chase Manhattan Bank

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The Coal Situation

Vol. 1 – No. 2
OCTOBER, 1980

$99 BILLION FOR COAL

The nineteen eighties will be a period of energy transition as world economies turn increasingly to coal as a primary energy source.

Led by an accelerating growth in usage by the electric utility and industrial sectors and the start of synthetic fuels from coal in the latter half of the decade, annual world coal consumption is expected to reach 6.2 billion tons by 1990, an increase of 2.4 billion tons over actual 1978 levels. The non-Communist areas of the world are expected to exhibit the highest rate of growth, with their share of total consumption increasing from 43 percent in 1978 to 45 percent by 1990. This growth in non-Communist coal requirements will be met essentially through the expansion of the coal industries of the nations comprising this segment of the world's economies. The following is an analysis of production patterns and associated capital required to support the expansion of the non-Communist coal industry.

PATTERNS OF PRODUCTION

In 1978, coal production in the non-Communist world was almost 1.6 billion tons and by 1990 production is forecasted to reach 2.7 billion tons. The detailed regional breakdown of these production levels is shown in Table 1. Also shown are the shares of production by sector: private enterprise, government-related, and developing countries. The private enterprise sector comprises the countries where coal production is in the hands of investor-owned companies, and includes the United States, South Africa, Australia, Japan, and Canada*. The government-related sector includes the government-owned or controlled industries of Europe and India while the developing country segment represents those nations of Africa, Asia, and Latin America that presently lack any significant coal industry.

As shown in Table 1, the United States is expected to maintain its position as the largest single producer in the non-Communist world, producing 49.2 percent of the total or 1.3 billion tons in 1990. The U.S. normally accounts for about 50% of worldwide production. In recent history, the prolonged strike in 1978 made that year the only exception.

TABLE 1
SHARE OF NON-COMMUNIST WORLD COAL PRODUCTION
(Percent)

	1978	1990
By Region		
United States	42.0	49.2
Canada	2.1	2.3
Latin America	0.9	1.7
Europe	30.5	21.0
Africa	6.7	8.4
Asia	10.1	9.2
Australia/New Zealand	7.7	8.2
Total	100.0	100.0
By Sector		
Private Enterprise	59.5	68.3
Government-Related	37.6	27.7
Developing Countries	2.9	4.0
Total	100.0	100.0

The most significant regional change during the decade is the relative decline of European production and the relative increase in Africa, Australia, and Latin America. The decline in the European share of total output can be traced to resource depletion and the high cost of mining. European expansion difficulties also produce a decline in the relative importance of the government-related coal industry, although, in absolute terms, production from this sector will continue to grow at 2% per year. Thus, the member nations of the government-controlled category will become increasingly dependent upon coal imports.

Through the decade, coal output in the non-Communist world will be dominated increasingly by the private enterprise sector. With the exception of Japan, each country having a private enterprise coal industry is expected to increase its share of output over 1978. Japan's decline in relative importance reflects resource depletion that will limit output to current levels.

*Included in the Canadian data is a segment of coal production by the government-owned industry in Nova Scotia.

Developing countries are also expected to increase their share, with 1990 production representing 4% of the total versus less than 3% in 1978. The key countries involved in this expansion are Colombia, Brazil, and Indonesia.

To support a 1990 production level of 2.7 billion tons, the non-Communist coal industry will require significant new production capacity, not only to meet the increased demand but also to replace existing facilities as present reserves are depleted. Assuming an average life of 25 years for underground mines and 19 years for surface mines, existing capacity will decline at 4.2 percent a year with the result that by 1990 over half of the capacity that existed in 1978 will have to be replaced. This will need to be supplemented by an additional billion tons of capacity to meet the higher 1990 production needs. Thus, by 1990, the non-Communist world coal industry will need to make investments to support almost two billion tons of new capacity, or as much as the total capacity that existed in 1978.

INVESTMENT NEEDS

Investment requirements for new mine operations are site specific and vary substantially, depending on the type and scope of mining operations, mining conditions, and existing infrastructure. For instance, capital requirements associated with the mine complex itself range from $35-$65 (1980 U.S. dollars) per ton of annual capacity installed for underground mines and $18-$70 (1980 U.S. dollars) per ton of annual capacity for surface mines. Infrastructure requirements, such as transportation, new town development, and shipping capabilities vary widely and can add another $10-$105 per ton (1980 U.S. dollars).

In forecasting the non-Communist investment needs in coal, the required expenditures for typical underground and surface operations were estimated for each region, based on the above ranges of capital needed for building both mines and infrastructure. Average capital requirements were then determined, based on future expectations for the split between surface and underground mines for each area.

This regional analysis leads to a cumulative investment need of about $99 billion (1980 U.S. dollars) in the eleven years starting in 1980 and running through 1990. The regional and sectorial breakdown of investment needs for the years 1980, 1985 and 1990 are shown in Table 2.

Regionally, at $38.7 billion, the United States coal industry leads the non-Communist world in cumulative investment requirements, followed by Europe at $25.5 billion and Australia at $13.1 billion. Sectorially, the private enterprise sector exhibits capital needs almost double the cumulative requirements of the government-related sector. Over the decade, coal industry expansion in the developing nations shows the highest rate of growth in investment requirements.

TABLE 2

CAPITAL INVESTMENT – 1980 THROUGH 1990

(Billion 1980 U.S. Dollars)

	1980	1985	1990	Cumulative 1980-1990
By Region				
United States	2.2	3.6	5.4	38.7
Canada	0.2	0.2	0.2	1.6
Latin America	0.2	0.6	0.7	4.7
Europe	2.3	2 3	2.4	25.5
Africa	0.4	0.8	0.8	6.4
Asia	0.7	0.7	0.9	8.9
Australia/New Zealand	1.0	1.2	1.4	13.1
Total	7.0	9.4	11.8	98.9
By Sector				
Private Enterprise	3.8	5.7	7.2	60.2
Government-Related	2.8	2.9	3.2	31.9
Developing Countries	0.4	0.8	1.4	6.8
Total	7.0	9.4	11.8	98.9

SOURCES OF FINANCING

Though we have not attempted to quantify the level of external financing that will be required to support the expansion of the coal industry, some general comments are in order.

First, the expected industry expansion through 1990 will make it difficult to finance mine expansion solely through revenues from existing coal mining operations. Parent companies will have to rely on revenue from other operations or from outside financing. In general, the industry is expected to become more leveraged, using project finance techniques where appropriate to finance major new operations.

In the United States, accounting for two-thirds of the total private enterprise sector's investment needs, historical trends are expected to continue. That is, the share of total production by purely coal mining companies will continue to decline. These companies are mainly small, privately financed organizations. Most coal capacity expansion for use within the United States will be undertaken by subsidiaries of non-coal mining parents, most importantly oil companies, electric utilities, and general mining companies.

The one exception to this trend is mine development for international trade. Since 1973, foreign-based firms have slowly been acquiring reserves or active mining companies in the United States to support export trade. German and British interests have been the most active, with Dutch and French groups the more recent entrants. Most recently, the Japanese have become heavily involved in assessing opportunities in the U.S.

In Australia, the major portion of the expansion in coal operations is expected to be for export, principally to Japan. As a result, the Australian coal industry will continue to be highly international in flavor, with a large number of participants ranging from consumers to multinational oil companies to government groups such as Britain's National Coal Board. Mines are expected to be multi-participant ventures using project finance techniques.

Second, the governments involved will probably meet most of the financing needs of the government-related sector with public funds. The exceptions to this situation may be India and Turkey. Although each has nationalized its coal industry, difficulties in internal capital formation may require international banking community support for investment needs.

Finally, even though the investment requirements of developing nations are small, financing will be difficult. Coal production in many of the developing nations will be primarily for domestic consumption, for which foreign equity funding is difficult. As pointed out in the World Bank's publication, *Coal Development Potential and Prospects in Developing Countries*, "LDCs will look to bilateral and international agencies as well as commercial banks to supplement budgetary allocations." The World Bank estimates that two thirds of LDC funding will have to come from external financing sources.

A number of international groups have already signed or negotiated exploration and development contracts in developing nations: Exxon and others in Colombia; firms from the United States, England, Japan and South Korea in Indonesia; and Anglo-American and Royal Dutch Shell Oil in Botswana and Swaziland. The Japanese government has a program to subsidize general coal development research projects abroad, to finance overseas exploration projects, and to guarantee private loans for coal development in foreign countries. The World Bank notes that "these efforts are directly linked to coal development for exports whereby foreign sponsors provide equity financing or loans secured by long-term sales contracts."

SUMMARY

To sum up, the nineteen eighties are likely to see a reversal of the fortunes of the coal industry in the non-Communist world. After declining for much of the post-World War II period, coal will increase its share of world energy supplies. Meeting the goals implicit in this new role will be expensive by past standards in the coal industry, but not unduly expensive in comparison to the investment needs of the other energy industries. The coal industry's cumulative expenditures during the eighties estimated at $99 billion (1980 U.S. dollars) are less than half the expenditures Chase estimates will be required by the world petroleum industry in the year 1990 alone. If the current financing trend continues, more than half of the coal industry's future capital needs will be met from external sources of funds, with the international banking community playing a major role in meeting those needs.

Vincent J. Calarco, Jr.

FINAL NOTICE

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With this second issue, we have continued to send *The Coal Situation* to an expanded mailing list. As of the third issue, however, the mailing list will include only those who have sent in the coupon on the back page. IF YOU WOULD LIKE YOUR NAME TO BE PLACED ON THE PERMANENT MAILING LIST FOR *THE COAL SITUATION*, PLEASE FILL OUT THE MAILING SLIP AND SEND IT IN BEFORE DECEMBER 31, 1980. In the future, names can be added to the list by calling (212) 552-5080, or writing to:

William Ruhlmann
Production Editor
Energy Economics Division-10th Floor
The Chase Manhattan Bank, N.A.
1 Chase Manhattan Plaza
New York, N.Y. 10081

UNITED STATES COAL BALANCES

	APRIL THRU JUNE			YEAR TO DATE		
	1980	1979	CHANGE	1980	1979	CHANGE
	Million Short Tons		–%–	Million Short Tons		–%–
Consumption						
Electric Utilities	127.98	124.52	2.78	272.55	255.09	6.84
Coking Plants	17.70	19.75	–10.38	36.48	39.13	– 6.77
General industry	15.70*	15.81	– 0.70	32.18**	33.69	– 4.48
Retail Deliveries	1.75*	1.57	11.47	4.20**	4.26	– 1.41
Total Domestic Demand	163.12*	161.65	0.91	345.40**	332.18	3.98
Exports	25.06	17.46	43.53	39.19	28.43	37.85
Total Demand	188.18*	179.11	5.06	384.59**	360.61	6.65
Supply						
Domestic Production	220.07	204.12	7.81	423.35	383.50	10.39
Imports	0.37	0.48	–22.92	0.78	1.04	–25.00
Total New Supply	220.44	204.61	7.74	424.13	384.55	10.29
Stock Change	32.26	25.50	–	39.53	23.94	–

Totals may not add due to rounding
*Estimated
**Revised Jan-Mar 1980

Sources: U.S. Department of Energy
National Coal Association
Chase Manhattan Bank

EUROPEAN ECONOMIC COMMUNITY COAL BALANCES – HARD COAL

	APRIL THRU JUNE			YEAR TO DATE		
	1980	1979	CHANGE	1980	1979	CHANGE
	Million Short Tons		–%–	Million Short Tons		–%–
Deliveries to:						
Electric Utilities	48.91*	44.88	8.98	99.40	87.70	13.34
Coke Plants	24.86*	24.40	1.89	48.56	47.86	1.46
General Industry	5.93*	5.96	– 0.50	12.37	12.51	– 1.12
Retail Deliveries	4.63*	5.23	–11.47	10.27	11.21	– 8.39
Total Domestic Demand	84.33*	80.47	4.80	170.60	159.27	7.11
Exports	0.36*	0.50	–28.00	0.75	1.27	–40.94
Total Demand	84.69*	80.98	4.58	171.35	160.56	6.72
Supply						
Domestic Production	66.02	64.15	2.92	139.80	135.24	3.37
Imports – Third Party	21.11	15.81	33.52	39.34	28.48	38.13
Total New Supply	87.13	79.95	8.98	179.15	163.72	9.42
Stock Change	2.44	–1.02	–	7.80	3.17	–

Totals may not add due to rounding
* Estimated

Sources: Eurotstat
Chase Manhattan Bank

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The Coal Situation

A quarterly review from Energy Economics — THE CHASE MANHATTAN BANK, N.A., NEW YORK, N.Y. 10081

SPECIAL ISSUE
DECEMBER, 1980

POLAND AND THE INTERNATIONAL COAL MARKETS

In 1979, Poland supplied 41.4 million metric tons or 18 percent of the coal traded internationally. This was exceeded only by the United States, with exports of 59.9 million tons. The deterioration of labor relations within the country and the threat of a Soviet invasion obviously raises the level of concern regarding Polish coal supplies. This special issue of the *Coal Situation* will examine the ramifications that the events in Poland may have on the international markets for coal and other energy forms.

SIGNIFICANCE OF A POLISH SUPPLY DISRUPTION

The impacts of a disruption of Polish coal supplies being experienced in 1980 and the potential for a more serious disruption in 1981 would, at first glance, be expected to be similar to those felt during the labor difficulties experienced in the United States in 1977-78, when coal exports fell by more than 12 million metric tons from the previous year export level. International consumers responded by going to stockpiles as well as to alternative coal sources. Within the United States, the loss of supplies was offset by stockpiles built up before the strike, coal supplies from non-union mines, and through the increased use of alternative energy including oil and nuclear power. As a result, the impact of the disruption of U.S. supplies in 1977-78 was minor. The potential implications of a major Polish disruption in 1981 are far more serious for two reasons.

First, since 1978, there has been a major change in the cost and availability of oil supplies. As a result of the Iranian Revolution and the current hostilities between Iraq and Iran, the world oil markets are in a precarious balance. Although the build-up of discretionary oil stocks (see, e.g., *The Petroleum Situation*, October, 1980) is tempering the impacts of the Iran-Iraq war, the imposition of additional oil demand to replace lost Polish steam coal supplies could contribute to a renewed leapfrogging of spot market oil prices.

Second, the short-term ability to obtain coal from alternative sources is greatly limited owing to the surge in demands following the instability in the oil markets and the rapid escalation of oil prices in 1979. The difficulty in obtaining alternative coal supplies is not centered on the inability of coal producers to expand production. The U.S. alone possesses sufficient idle capacity to make up the supply shortfall in a relatively short period of time. Rather, the difficulty rests with the potential inability of world suppliers to physically deliver the coal to the consumer. Richards Bay, the South African export facility, is presently operating at full capacity. In the United States, existing port facilities are being taxed to the limits, causing heavy demurrage charges to shippers. Australia is the only major producer possessing some degree of flexibility. But the absolute level of any Australian increase is debatable.

Of the 41.4 million metric tons of coal Poland exported in 1979, 33.0 million metric tons (79.7 percent) was steam coal largely used by the utility sector. Only 8.4 million metric tons was metallurical grade coals.. As is shown in Table 1, Western Europe received over 58 percent of Poland's 1979 coal exports, non-European Western countries 5.8 percent, and the Socialist countries received 36.2 percent of Polish exports in 1976.

TABLE 1
POLISH HARD COAL EXPORTS – 1979

	Steam Coal		Metallurgical Coal		Total	
	Million Metric Tons	Percent of Total	Million Metric Tons	Percent of Total	Million Metric Tons	Percent of Total
Western Countries						
Europe	18.1	54.9	6.0	71.4	24.1	58.2
Non-Europe	0.6	1.8	1.7	21.2	2.3	5.8
Sub Total	18.7	56.7	7.7	92.6	26.4	63.8
Socialist Countries	14.3	43.3	0.7	8.4	15.0	36.2
Total	33.0	100.0	8.4	100.0	41.4	100.0

The estimated imports of Polish coal by country and the relative importance of these supplies to the country's total imports are shown in Table 2. In absolute volumes, the Soviet Union, which imported 9.4 million tons in 1979, is the biggest importer of Polish coal. These supplies also represent nearly all of the coal the Soviet Union imports. In the Western world, France, Finland, Italy, Denmark, and Germany are the largest recipients of Polish coal. Finland is most dependent, with about 91 percent of its imports coming from Poland. Denmark is second, with over 41 percent.

EXTENT OF POLISH SUPPLY DISRUPTIONS

The impact of the September miners' strike and subsequent work rule changes on Polish 1980 exports is still being assessed. The latest information from the Mining Ministry is for a drop of 8-9 million metric tons from 1979. Most of this shortfall would be experienced in the fourth

TABLE 2
ESTIMATED 1979 POLISH COAL IMPORTS BY COUNTRY

Country	Million Metric Tons	Percent of Countries Total Coal Imports
Western Countries		
France	4.6	16.8
Finland	4.3	89.6
Italy	3.3	23.7
Denmark	3.1	41.3
Germany (FR)	2.6	33.3
Spain	1.3	31.0
Brazil	1.2	26.7
Austria	1.0	35.7
All Others	5.1	4.1
Total	26.5	13.5
Socialist Countries		
U.S.S.R.	9.4	99.0
Czechoslavakia	2.2	41.5
Germany (DR)	2.0	33.3
Other	1.3	11.1
Total	14.9	45.9
Total	41.4	18.1

quarter. This coincides with a continued strong European demand for U.S. coal, particularly for steam coal supplies.

Plans made prior to the labor disruptions, which have not yet been revised, called for production levels of approximately 210-212 million metric tons in 1981. With expectations for continued labor unrest and the impacts of work rule changes, such as a 5-day work week, won by labor in September, it is unlikely that these targets can be achieved. The best that can be hoped for is that hard coal production will equal the 1980 level of 190-195 million tons.

In addition, coal provides approximately 85 percent of Poland's energy needs. Most likely, domestic consumers will be given priority, so the export market is anticipated to bear the brunt of any shortfalls in production. The prospects for Western importers are even worse since it is highly likely that Poland's sister members of the Comecon organization (Soviet Union, Czechoslovakia, East Germany, etc.,) will be given the next highest priority. In other words, the Western nations, principally in Europe, must be prepared to experience the full extent of any Polish coal production shortfall.

In the most extreme scenario, a Soviet invasion that is met by a militant labor force could result in a disruption in Polish supplies that could range up to an entire year. Such an event, although possible, still would seem to have a very low probability. At a minimum, a labor force, either from the military or from another Comecon nation could be called in to continue mining operations. A slightly more probable outcome under an invasion scenario would be a complete loss of exports to Western nations, and some shortages in Eastern Europe. The impact of the loss of all Polish exports is analyzed below. The resulting shortfalls in Polish coal availabilities in 1981 are shown in Table 3.

TABLE 3
POSSIBLE POLISH COAL EXPORT SHORTFALLS
1981 VERSUS 1979
(Million Metric Tons)

	Western Countries	Socialist Countries	Total
No–Invasion Scenario	−15.0	0	−15.0
Invasion Scenario (Loss of all exports)	−26.5	−14.9	−41.4

IMPLICATIONS OF 1981 SHORTFALLS

Under the *no-invasion* scenario, the Western countries would have to replace approximately 15 million tons of coal, approximately twice the replacement quantity expected for 1980. Some of the shortages will be made up from stockpiles. Also, additional supplies will be available from the U.S. and Australia in 1981, approximately 4 million tons and 1 million tons, respectively. As a result, the high demand pressures on U.S. supplies created in 1980 will be maintained and increased in 1981. Port facility bottlenecks will continue and heavy demurrage charges should be expected. In general, the no-invasion scenario, although creating difficulties, would not lead to significant disruptions in economic activity. The invasion scenario, however, raises serious concerns.

The total loss of a quantity of coal equal to Poland's 1979 exports, could not be replaced by coal from alternative sources including stockpiles. Optimistically, only half of this quantity could be made up by additional supplies from the U.S., Australia and other locations, and the remainder would have to come from increased oil usage and decreased energy demands because of higher energy prices and lower economic activity.

There would also be a direct impact on coal prices. The scramble to replace lost supplies from Poland would result in a bidding war for short-term supplies that could be expected to cause a 30-40 percent increase in spot market prices, primarily in steam coal prices. Bottlenecks at U.S. port facilities would continue, and similar difficulties would begin to appear in Australia. In addition to the impacts of demurrage charges, ocean freight rates should start to show significant increases.

Over 95 percent of the Polish coal delivered to Western countries is by ocean vessel, with approximately half of the ocean trade in Polish ships. An invasion met with a militant labor force would severely impact the availability of Polish ocean vessels. The lack of Polish flag vessels, together with the need for longer distance transportation of alternative coal supplies, would result in significant increases (10-20%) in ocean freight rates.

The inability to replace Polish coal with alternative coal supplies could stimulate renewed leap-frogging of oil prices such as followed the Iranian Revolution. A 15-18 million ton shortfall equals approximately 170-210 thousand barrels of oil per day. This is less than half a percent of 1981 world oil demands, but it would occur at a time when the world oil market is in a precarious balance.*

CONCLUSIONS

The level of uncertainty surrounding the Polish situation and the possible severity of the outcome clearly indicate a need to closely watch the events in Poland. At a minimum, coal shippers, producers, and users can expect to see a continuation of the heavy demand pressures for U.S. coal suppliers and an increase in demand for Australian coal. At the extreme, an invasion by the Soviet Union would produce rapidly escalating spot market coal prices, further port congestion in the U.S. and Australia, and a significant increase in freight rates. In addition, the need to replace a portion of the lost supplies with oil greatly increases the potential for renewed price instability for world oil markets.

Vincent J. Calarco

* The reader should refer to Chase's October, 1980 issue of *The Petroleum Situation* for a fuller discussion of the current world oil markets.

The Coal Situation

Vol. 1 — No. 3
MARCH, 1981

SHORT-TERM OUTLOOK FOR WORLD COAL TRADE

In 1980, international coal trade occupied much of the world's attention in coal. During the year, a number of independent analyses all concluded that there would be a sustained, significant growth in the international movement of coal throughout the decade and well into the next. At the same time, however, there was considerable concern about difficulties currently being experienced in individual markets.

In the United States, strong international demand resulted in record levels of coal shipments. The increase in U.S. exports, estimated at almost 24 million tonnes, or 39 percent greater than 1979 shipments of 60 million tonnes, greatly taxed existing port facilities, resulting in ship delays of up to 45 days and heavy demurrage charges. These difficulties have brought into sharp focus concerns over the adequacy of port facilities worldwide to meet the anticipated growth in world coal demands.

In part, the growth in U.S. coal exports reflects the initial signs of the longer term potential for international trade that analysts have predicted. The surge in U.S. exports, however, also indicates the shift in trading patterns caused by consumer response to the disruption of coal supplies because of labor disputes in Australia and Poland. While the Australian disputes have been resolved, the Polish situation remains as a major market influence in the foreseeable future.

The purpose of this issue of the *Coal Situation* is to analyze the short-term outlook for world coal trade in the context of the expectations for continued supply disruption in Poland and transportation bottlenecks in other exporting areas.

Polish Coal Update

Over two months have passed since we first analyzed the international implications of the disruption of Polish coal exports in a Special Issue of the *Coal Situation*. In that December report, we estimated that the best Poland could accomplish in 1981 was coal exports amounting to 26 million tonnes, or 64 percent of its peak level of trade in 1979. The basic foundation for this forecast was the impact of the work rule changes won by labor in 1980. The possibility of the complete elimination of Poland coal exports existed at the time of that writing because of the threat of a Russian invasion.

While this threat has subsided, the potential for a complete supply cut-off to the international markets has not. What has happened in the last two months to lead to this conclusion is a fuller understanding of the extent of the impacts of the work rule changes.

Poland's government forecasts call for exports of 22 to 24 million tonnes in 1981, only slightly lower than the forecasts made in the December issue of the *Coal Situation*. The Polish government, however, has warned its labor force that a strict adherence to the work rule changes could result in total production of coal falling well below internal needs, thus eliminating any coal exports. At this point, we must assume that there will be a positive response by labor to the government's call for voluntary work on weekends and that exports of slightly less than official government levels can be achieved. The potential for further cutbacks, however, will accentuate the shift in world trading patterns as importers of Polish coal hedge their risks.* Thus there will be continued heavy pressure on other international suppliers to replace Polish coal. Further aggravating the situation are anticipated cutbacks in Russian coal exports.

The ability and/or willingness of the Soviet Union to maintain its level of coal trade, approximately 22 million tonnes in 1980, has been affected by both its reduced imports from Poland and difficulties with its own coal production. In 1980, Soviet imports of Polish coal fell by approximately 3 to 4 million tonnes. Simultaneously, Soviet coal output fell short

*The reader should refer to the December Special Issue of the *Coal Situation* for a breakdown of the countries affected by the Polish coal disruption.

of planned production levels. In fact, Soviet coal output in 1980 was approximately 3 million tonnes lower than the 719 million tonnes produced in 1979. Therefore, the Soviets have been forced to announce cutbacks in 1981 coal exports which will further accentuate the shift in the patterns of coal trade, aggravating the port bottlenecks and difficulties experienced by coal importers in 1980.

Thus, in 1981 and beyond, coal importers are faced with the task of replacing the shortfall in coal supplies from Poland and the Soviet Union while simultaneously meeting additional demands. The alternatives available to accomplish these tasks are limited.

United States

The ability of the international consumer to obtain additional coal supplies from the U.S. is influenced by three factors. First, in response to the heavy interest by the international consumers in 1980, a large number of port improvements or additions have been announced. While not significantly alleviating the existing shipping bottlenecks until 1982 and beyond, the improving facilities on the east coast, increased use of facilities in the Gulf States, and the use of short-term alternative delivery routes such as through the Great Lakes provide some short-term relief.

Second, the anticipated growth in international coal demands is principally in the form of steam coal. In 1981, U.S. exports of metallurgical coal are expected to decline, thus allowing the shipment of additional quantities of steam coal through existing facilities. The expected decline in the U.S. shipments of metallurgical coal is the result of continued softening of demands from the European steel industry and the elimination of the Japanese metallurgical coal demands produced by the now-resolved labor disputes in Australia during 1980.

Finally, offsetting the improvement in U.S. exporting capabilities in 1981 is the potential of a strike when the United Mine Workers contract expires at the end of March. As of this writing, we attach a 50 percent likelihood to a strike lasting one month.

The three considerations cited above lead to a forecast of a very modest rise in U.S. exports in 1981 over 1980. This modest overall growth, however, masks the continuing dramatic increase in steam coal exports, while metallurgical shipments decline. By 1982, U.S. labor stability and further improvements in exporting facilities will provide the ability to respond to increased international market demands.

Australia

Barring a renewal of the labor difficulties experienced in 1980, Australia will see the return of the Japanese metallurgical coal sales lost to the U.S. in the third and fourth quarters of 1980. In addition, there will be a continuation of the expansion of Australian steam coal trade, principally in response to the growth in the Japanese and Asian markets, but also in response to the Polish and Russian situations. This trend is expected to be carried over into 1982 and beyond.

As far as Australian port facilities are concerned, the situation differs slightly from that in the United States. Existing loading and shipping capabilities are adequate to meet the tonnage requirements for 1981 and 1982. The surge in Australian exports, however, will force higher utilization of ports that will result in the development of short-term bottlenecks and ship delays. The delays, however, will not be nearly as severe as those experienced in the U.S.

Other Exporting Countries

As for the remaining coal exporting countries of the world, generally speaking, the international coal importer, although able to acquire additional quantities, will find it difficult to obtain significant increases in 1981 and 1982. The most notable exception to this situation will be the United Kingdom.

In the U.K., recession and increased imports of cheaper coal have resulted in excess coal production by the National Coal Board mines. This situation has been further exaggerated by labor's ability to get management to capitulate on plans to close a number of mines. The need to replace Polish and Russian coal supplies by continental Europe, coupled with the high demurrage charges for U.S. supplies, provide the opportunity for the U.K. to export a portion of their excess production. The key to the Coal Board's ability to tap this opportunity rests with the price it is willing to accept for the coal. Currently, imported coal from the U.S., including demurrage, is cheaper than the cost of British coal at the colliery.

Short-Term Trade Forecast

The estimated level of hard coal trade in 1979 and 1980 and the forecasted levels of trade in 1981 and 1982 are shown in Table 1. There are three key points to be noted in these forecasts.

First, as stated previously, the significant cutback in Polish and Russian exports produces a shift in trading patterns to other areas of the world. Based on total exports, the most significant increase in volume

terms comes from Australia with 1981 exports increasing by over 8 million tonnes above estimated 1980 levels. The United States exhibits only moderate growth in 1981 over 1980 exports. As mentioned above, this trend, however, masks the changes in the type of coal exported.

Second, steam coal exports in 1981 will continue to exhibit the effects of the world's movement back to coal as a primary energy source. In the case of metallurgical coal, the recessionary impacts on the Western European steel industry and economic difficulties in Eastern Europe will result in a decline in metallurgical coal trade in 1981 relative to 1980. The net effect will be a very modest increase in total trade in 1981.

The final point to be drawn from the forecasts shown in Table 1 is that improving economic activity and the continued emphasis on coal as a primary energy source by the oil-dependent, coal-resource-poor areas of the world should produce an acceleration in coal trade between 1981 and 1982, a trend that is expected to continue throughout the decade.

The next issue of *Coal Situation* will examine in greater detail the longer term outlook for world coal trade. Special emphasis will be paid to the question of the major exporting countries' ability to develop on a timely basis the necessary transportation infrastructure needed to meet the world's growing appetite for coal.

Vincent J. Calarco, Jr.

TABLE 1
WORLD HARD COAL TRADE
(Million Metric Tons)

	MET COAL				STEAM COAL				TOTAL			
	1979(E)	1980(E)	1981	1982	1979(E)	1980(E)	1981	1982	1979	1980(E)	1981	1982
EXPORTER												
U.S.	46.0	57.1	49.0	52.4	13.9	26.4	36.5	40.3	59.9	83.5	85.5	92.7
AUSTRALIA	34.7	35.1	40.0	44.0	5.7	7.0	10.6	14.5	40.4	42.1	50.6	58.5
SOUTH AFRICA	2.0	2.0	2.0	2.0	21.4	24.0	24.5	24.9	23.4	26.0	26.5	26.9
W. GERMANY	8.6	7.5	8.0	9.0	6.7	6.5	7.4	7.0	15.3	14.0	15.4	16.0
CANADA	12.5	13.0	13.5	13.8	1.4	1.5	1.9	2.2	13.9	14.5	15.4	16.0
OTHER	4.3	4.7	5.0	5.4	6.4	6.8	9.9	10.4	10.7	11.5	14.9	15.8
SUB-TOTAL	108.1	119.4	117.5	126.6	55.5	72.2	90.8	99.3	163.6	191.6	208.3	225.9
POLAND	8.4	6.4	5.4	5.4	32.9	24.9	15.0	21.0	41.3	31.3	20.4	26.4
USSR	10.8	9.3	8.3	8.3	13.1	12.3	10.3	10.3	23.9	21.6	18.6	18.6
TOTAL	127.3	135.1	131.2	140.3	101.5	109.4	116.1	130.6	228.8	244.5	247.3	270.9
IMPORTERS												
N. AMERICA	6.9	5.9	6.0	6.9	12.6	11.8	12.7	12.7	19.5	17.7	18.7	19.6
LATIN AMERICA	5.7	6.1	6.6	7.2	0.6	1.0	1.3	1.5	6.3	7.1	7.9	8.7
EEC	29.5	30.6	27.0	30.2	48.5	54.4	56.5	58.2	78.0	85.0	83.5	88.4
OTHER W. EUROPE	11.0	11.1	10.5	11.5	8.5	8.6	9.8	10.0	19.5	19.7	20.3	21.5
EAST EUROPE	12.0	12.5	11.9	12.9	20.5	17.6	15.2	22.1	32.5	30.1	27.1	35.0
JAPAN	55.6	62.1	62.0	64.0	2.3	6.5	10.3	15.2	57.9	68.6	72.3	79.2
OTHER	6.6	6.8	7.2	7.6	8.5	9.5	10.3	10.9	15.1	16.3	17.5	18.5
TOTAL	127.3	135.1	131.2	140.3	101.5	109.4	116.1	130.6	228.8	244.5	247.3	270.9

(E) Estimated

UNITED STATES COAL BALANCES

	JULY THRU SEPT			JAN THRU SEPT		
	1980	1979	CHANGE	1980	1979	CHANGE
	Million Short Tons		–%–	Million Short Tons		–%–
Consumption						
Electric Utilities	154.71	138.93	11.36	427.26	394.02	8.44
Coking Plants	14.58	19.26	–24.30	51.06	58.39	–12.55
General Industry	14.90*	15.75	– 5.40	46.11**	49.44	– 6.74
Retail Deliveries	1.55*	1.43	8.39	5.19**	5.69	– 8.79
Total Domestic Demand	185.73*	175.37	5.91	529.60**	507.55	4.34
Exports	25.88	17.69	46.30	65.07	46.12	41.09
Total Demand	211.62*	193.06	9.61	594.68**	553.67	7.41
Supply						
Domestic Production	209.15	189.80	10.19	625.56	573.30	9.12
Imports	0.20	0.59	–66.10	0.98	1.63	–39.88
Total New Supply	209.35	190.39	9.96	626.54	574.94	8.97
Stock Change	– 2.27	– 2.67	–	31.86	21.27	–

Totals may not add due to rounding
*Estimated
**Revised April-June 1980

Sources: U.S. Department of Energy
National Coal Association
Chase Manhattan Bank

EUROPEAN ECONOMIC COMMUNITY COAL BALANCES – HARD COAL

	JULY THRU SEPT			JAN THRU SEPT		
	1980	1979	CHANGE	1980	1979	CHANGE
	Million Short Tons		–%–	Million Short Tons		–%–
Deliveries to:						
Electric Utilities	46.18	44.40	4.01	145.19	132.10	9.91
Coke Plants	24.56	23.46	4.69	73.55	71.32	3.13
General Industry	5.99	5.71	4.90	18.28	18.28	0.00
Retail Deliveries	4.35	4.70	–7.45	14.65	15.95	–8.15
Total Domestic Demand	81.08	78.26	3.60	251.68	237.63	5.91
Exports	0.11	0.35	–68.57	0.70	1.62	–56.79
Total Demand	81.19	78.61	3.28	252.37	239.27	5.47
Supply						
Domestic Production	62.07	60.00	3.45	201.87	195.24	3.40
Imports – (Third Party Countries)	21.45	16.79	27.75	61.43	45.31	35.58
Total New Supply	83.52	76.79	8.76	263.31	240.56	9.46
Stock Change	2.33	–1.82	–	10.93	1.29	–

Totals may not add due to rounding
* Estimated

Sources: Eurotstat
Chase Manhattan Bank

The Coal Situation

A quarterly Review from Energy Economics — THE CHASE MANHATTAN BANK, N.A. NEW YORK, N.Y. 10081

Vol. 1 – No. 4
JUNE, 1981

WORLD COAL TRADE - LONG-TERM OUTLOOK

Labor disputes that interrupt the free flow of coal supplies, inadequate port facilities that limit export capabilities and make transportation inefficient and costly, and of course the continuing concern over the environmental consequences of increased coal burning: these are familiar coal-related topics widely seen in the media today. When added to the anticipation of reduced growth in world economic activity, consumer emphasis on energy conservation through efficiency of energy use, and the emergence of an "oil glut," the result is an increasingly uncertain outlook for world coal trade. This is particularly critical to those firms that are contemplating or have already committed significant investments in the export markets for coal. Whether one is a coal producer, shipper, or trader, the uncertainties caused by these conditions raise concern about the future levels of international coal demands and about the trading patterns necessary to satisfy these demands. This issue of the *Coal Situation* provides an assessment of the long-term outlook for coal trade in the context of the uncertainties facing the marketplace.

As will be shown, coal trade is anticipated to reach over 455 million tonnes per year by 1990, essentially double the amount traded in 1979. While changes in the historical pattern of trade will emerge, the international scene will continue to be dominated by supplies originating in the United States, South Africa, Australia, and Canada. Over the decade, the coal industries of these nations are expected to satisfy almost 83 percent of the forecasted incremental coal trade.

World Energy Demand and Coal

Through the 1980s, the growth in world energy demand will continue to reflect the significant divergence from historical rates that began in 1973-74. As shown in Table 1, total world primary energy demand from 1980 through 1990 is expected to increase at an average compound growth rate of 2.7 percent per year, reaching 375 quadrillion BTUs per year by 1990.

According to United Nations statistics, between 1963 and 1973 the world economies were increasing their consumption of energy at an average compound growth rate of 5.4 percent per year. Led by oil, the explosion in energy prices beginning in 1973-74 cut this rate of expansion in energy usage in half, to an average rate of 2.6 percent per year during the period 1973 to 1979. In response to significantly higher prices for energy, this slowing of the world's growth rate in energy usage was caused by the significant slowing in the growth of worldwide economic activity and increased emphasis on energy conservation. "Conservation" is defined here to be mean efficient energy usage such as the substitution of small, high-mileage automobiles for "gas guzzlers." Since 1973, slowed growth in economic activity has been the dominant reason for the decline in the rate of growth in energy consumption, but the impact of energy conservation is growing, and is expected to be the major influence in establishing the pattern of energy usage in the 1980s. This is particularly true given the impact of the second OPEC price explosion in 1979/80.

While we expect the next year or two to be a period of recovery for world economies, the rate of growth in industrial activity over the decade will be lower than that experienced during the "cheap energy" era of the fifties and sixties. Together, lower economic growth and energy conservation produce a pattern of growth in energy demands shown in the regional breakdown of energy consumption in Table 1.

TABLE 1
WORLD TOTAL PRIMARY ENERGY DEMAND 1980-1990
(10^{15} BTU/Yr.)

	1980	1985	1990	GROWTH RATE 1980-1990 %/YEAR
Developed Market Economies	158.8	175.1	190.4	1.8
Less-Developed Economies	38.6	49.1	62.1	4.9
Centrally Planned Economies	89.6	105.6	122.5	3.2
TOTAL	287.0	329.8	375.0	2.7

As shown, the developed market economies exhibit the lowest rate of expansion in energy needs. In contrast, the less-developed market economies and the centrally planned economies exhibit significantly higher energy growth rates. In total coal will have to compete to capture its share of a total energy demand that will be expanding at a slower rate than in the past. Consequently, the rate of expansion in the use of coal will be slowed also. The most significant impacts will be felt in the metallurgical coal sector, where lower growth in steel output will affect the quantity of coal needed to produce coke for the blast furnace. Lower economic activity and greater energy conservation will affect other coal markets. For instance, the slowing in the rate of growth in electricity consumption in the United States, from historical rates of 6% to 7% per year to 3% per year or less, will result in slower growth in coal requirements to fire boilers.

While the world coal industry will experience the impacts of more slowly expanding energy demands in specific market sectors, the market for coal overall will be expanding at a rate greater than the total growth in energy demands, as shown in Table 2. This also holds for all other energy forms, with the exception of oil. This has occurred because the high social, political, and economic costs of oil will lead to a shift away from oil and to an emphasis on alternative energy sources to meet future needs. This shift is expected to more than offset the decline in total energy consumption growth rates.

TABLE 2
WORLD PRIMARY ENERGY DEMAND
(10^5 BTU)

	1980	1985	1990	GROWTH RATE 1980-1990 %/YEAR
Oil	130.7	137.2	140.8	0.7
Gas	55.2	65.6	74.8	3.1
Coal	77.6	94.8	116.6	4.2
Nuclear	7.0	12.4	18.2	10.0
Other	16.5	19.8	24.6	4.1
TOTAL	287.0	329.8	375.0	2.7

The overall energy balance shown in Table 2 reflects our belief that throughout the eighties oil prices will continue to be under the influence of OPEC. Through the decade we expect to see oil price increases roughly averaging 3 percent per year above inflation. Some analysts believe that the combination of lower energy demand and increased supplies of alternative energy, including oil from non-OPEC producers, finally has broken the back of OPEC, and that price will stabilize. We think that, while the back is strained, it certainly is not broken. Continued world requirements of Persian Gulf oil, albeit at lower levels, along with the area's high political volatility lead to the conclusion that the cycle of supply disruption and massive price increases followed by an oil glut and stable prices we have seen occur twice in the last eight years is a pattern that could well continue in the 1980s. Alternately, even without such OPEC supply interruptions, we expect a Saudi-type long-term pricing strategy to be approved by OPEC in December, 1981. Such a strategy could lead to a roughly 3 percent per year increase in real OPEC prices.

The coal demand indicated in Table 2 suggests that the world coal industry will be required to produce over 5.6 billion metric tonnes of coal in 1990, almost 2 billion tonnes above actual 1979 production levels. While the production of coal will continue to be geared predominantly to domestic consumption, international trade will represent a growing proportion of the world's output of coal. The increase in trade occurs as oil-dependent, coal-resource-poor areas of the world diversify their energy supply away from oil. Table 3 shows a regional breakdown of coal import needs.

In 1990, coal imports are expected to reach 455.4 million tonnes, an increase of 226.6 million tonnes over actual trade in 1979. Western Europe, with incremental needs growing by 102.1 million tonnes, and Japan, up 61.6 million tonnes, make up 72 percent of the increase. The total growth in coal trade is dominated by the expansion in steam coal usage as the world replaces oil in electric power generation and industrial heat applications. Although metallurgical coal trade increases in absolute terms over the decade, sluggish expansion of the world steel industry produces a decline in its overall share of trade.

TABLE 3
WORLD COAL IMPORTS
(Million Metric Tons)

	1979	1990	Absolute Change
Importers			
North America	19.5	22.9	3.4
Latin America	6.3	22.7	16.4
Western Europe	97.5	200.0	102.5
Eastern Europe	32.5	39.9	7.4
Japan	57.9	122.5	64.6
Other	15.1	46.4	31.3
TOTAL	228.8	455.4	225.6
Percent of Total			
Steam Coal	44.4	59.8	
Metallurgical Coal	55.6	40.2	

In satisfying their needs for coal, the importing countries of the world will find a limited choice of alternative sources of supply. In 1979, 95 percent of coal entering international trade was supplied by seven countries—Australia, the United States, Canada, South Africa, West Germany, Poland, and the Soviet Union. Only four, Australia, the United States, Canada, and South Africa, possess the capabilities to make significant contributions to satisfying the level of coal trade needed by 1990. While the Soviet Union and Poland will continue to make a major contribution to the international markets, domestic requirements will limit their ability to expand. Moreover, the quantities of coal available for cross-border trade by these two members of the Communist community will shift increasingly toward trading partners in the COMECON organization, and away from the West.

West Germany, saddled by high mining costs and restricted ability to expand, will be limited to roughly the current level of exports, with the vast majority of these supplies remaining within the Western European region and more specifically assigned to trade with its European Economic Community partners.

As far as new entrants into the international arena are concerned, only two nations, Colombia and the People's Republic of China, have the potential to become major coal suppliers. The international community will see the entry of Colombian coal supplies during the period 1984-1987. The magnitude of Colombia's exports will be subject to the successful implemention of the country's massive plans for developing the Cerrejon coal deposits. As for China, significant contribution to meeting the international need for coal will be limited to the latter half of the decade, following massive improvements in transportation capabilities within the country and modernization of its mining industry.

International Coal Market Competition

In the competition to capture a share of the growing opportunities in coal trade, each of the four major suppliers have certain strengths and weaknesses. The United States possesses the largest known deposits of recoverable coal resources in the world, the largest coal-producing industry in the world, relatively the least restrictive environment for entry into all aspects of the coal supply business, and in general one of the safest investment environments in the world today. Together, these characteristics provided the United States coal industry with the ability to respond to international coal requirements to the tune of 83 million tonnes in 1980, 23 million tonnes greater than the level of U.S. coal exports in 1979. No other producing nation of the world possessed the capability to respond in such a short period of time to such a major

increase in market requirements. But while proving its strength, the experience of 1980 emphasized some weaknesses in the U.S. coal industry, particularly transportation. Clearly indicated was the need for modernization and expansion of U.S. port facilities. But this is a need common to all major competitors in the international market. Moreover, freedom of entry into all phases of the coal exporting business in the U.S. provides the ability to expand port facilities relatively quickly and therefore ease the restrictions on the physical export of additional quantities of coal. In fact, the combination of freedom of entry and the promise of future rewards have changed a concern over the lack of port facilities to a concern of overcapacity in the 1980s.

While the United States will undoubtedly have in place the port infrastructure required to serve a growing international market, the physical ability to deliver coal does not overcome the competitive disadvantage of the high costs of delivering U.S. coal to the pier, and then from the pier to the consumer. Dredging of harbors to allow the loading of larger vessels holds the promise of improving ocean freight rates. Improvement in the economics of transporting coal to the pier, however, is less promising. Alternatives such as river barge delivery to the Gulf Coast, while cheaper than rail, increase the distance of ocean vessel travel to the consumer, thus offsetting some of the benefits. Other weaknesses tied to U.S. coal exports, as viewed by the consumer, are the uncertainties of labor stability and, in general, higher mining costs.

Australia's major strengths in the international coal markets rest on abundant coal resources, government and coal industry dedication to the international market, and the country's physical proximity to the Asian markets. Counterbalancing these strengths are greater government involvement in the project-approval process and the "tyranny of distance" the country faces in competing for the European market segment. Also, like the United States, Australia is perceived to possess poor labor-management relations. While strikes are a reality in Australia, they tend to be more frequent and of shorter duration than those experienced in the U.S. Australia also faces the need to expand port facilities if it is to capture its market potential in the 1980s. Unlike the U.S., the Australian government is more heavily involved in the approval, development and operation of export facilities. To date, the government has indicated its commitment to the development of additional coal exporting facilities, including the dredging of harbors to allow for more economical transportation to the consumer.

The joint development by government and industry of the Richards Bay coal port and the associated rail facilities have made South Africa a major force in international coal markets. Through 1980, South Africa has proven itself to be a highly reliable, extremely competitive source of coal, a situation expected to continue through the 1980s. Obviously, however, the political uncertainties associated with apartheid rule create an aura of risk that influences the consumer's coal procurement strategies.

Perhaps of even greater influence on the level of South Africa's participation in international coal markets is the government control over exports. South African energy policy places great emphasis on assuring adequate availability of energy to meet future domestic needs. As such, coal exports are controlled through export licenses. Additional exports are allowed only after the government assures itself that resources are adequate to satisfy domestic requirements. Licenses have been approved that would allow the expansion of coal exports in 1985 to 44 million tonnes from the currently approved level of 26-28 million tonnes. Simultaneously, the government has approved and is participating in a Phase III expansion of Richards Bay and rail line improvements that together would provide the physical means to ship the approved export levels. Beyond 1985, export licenses will be granted consistent with the domestic resource situation. A recently completed assessment of coal resources within South Africa has resulted in a doubling of known coal deposits in the country. Therefore there is a high probability that additional exports will be allowed. Unofficial indications are that licenses will be granted for exports of up to 65 to 75 million tonnes by 1988-90, with additional expansion thereafter.

Offsetting these competitive advantages in terms of export coal-related availability, South African mining and infrastructure costs will increase significantly throughout this period. Therefore, the price-related advantages South Africa possessed in the late 1970s will be diminishing.

Of the four major traditional international coal suppliers holding the potential for making a major contribution to satisfying the world coal trade requirements, Canada ranks fourth. As in Australia, coal production in Western Canada (British Columbia and Alberta) is well located to take advantage of the anticipated growth in coal demands in the Pacific Basin, but suffers from a transportion-cost disadvantage relative to the European market. In addition, Canadian mining costs are relatively high, and massive initial infrastructure investment, particularly for rail transportation, is required if coal is to be moved to export market. While additional expansion and use of the transportation network would improve shipping exonomics over time, the initial suppliers are in the difficult position of negotiating with the provincial and federal governments for recognition of the importance of such an expansion.

Future Pattern of Coal Trade

As outlined above, relying on any one of the traditional major international suppliers of coal would involve certain risks and uncertainties, be they the result of labor, politics, or economics. This leads to a conclusion that importers in the 1980s will continue to engage in a risk management strategy of coal procurement that will require diversity in sourcing of coal supplies. As a result, all suppliers will benefit from the growing international demand for coal. The greatest benefits, however, will accrue to those areas perceived to possess the greatest security/economic advantages. Our assessment of the result of such considerations is shown in Table 4 below.

TABLE 4

WORLD COAL EXPORTS 1979-1990

(Million Metric Tonnes)

	1979	1990	Incremental Expansion	
			TONNAGE	% OF TOTAL
United States	59.9	126.6	66.7	29.6
Canada	13.9	27.2	13.3	5.9
Western Europe	19.8	20.6	0.8	0.4
South Africa	23.4	68.1	44.7	19.8
Australia	40.3	105.5	65.2	28.9
Other	0.8	23.7	22.9	10.2
SUB TOTAL	158.1	371.7	213.4	94.7
Communist Bloc	70.9	82.6	11.7	5.2
TOTAL	229.0	454.4	225.4	100.0

Throughout the decade, the United States and Australia are expected to obtain the greatest share of the growth in international coal trade, capturing 29.6 percent and 28.9 percent respectively of the incremental expansion of coal trade. Of the major suppliers, South Africa ranks third, with incremental trade growing by almost 44 million tonnes between 1979 and 1990. South Africa's share of trade is only limited by the greater control and more deliberate planning concerning allowable exports exerted by its government. In total, the four major international suppliers are expected to capture almost 83 percent of the incremental growth of total coal trade. Expansion by new entrants, principally Colombia and the People's Republic of China, represent the majority of the remaining 17 percent.

UNITED STATES COAL BALANCES

	----OCT. THRU DEC.----			----CALENDAR YR.----		
	1980	1979	CHANGE	1980	1979	CHANGE
	Million Short Tons		-%-	Million Short Tons		-%-
Consumption						
Electric Utilities	141.95	133.03	6.71	569.28	527.05	8.01
Coking Plants	15.61	18.97	-17.71	66.67	77.36	-13.82
General Industry	18.13	18.28	- 0.82	62.51	67.72	- 7.69
Retail Deliveries	2.90	2.71	7.01	7.59	8.40	- 9.64
Total Domestic Demand	178.58	172.98	3.24	706.03	680.53	3.75
Exports	226.67	19.90	34.02	91.74	66.05	38.82
Total Demand	205.24	192.87	6.41	797.69	746.54	6.85
Supply						
Domestic Production	214.64	207.83	3.28	835.40	781.13	6.95
Imports	0.21	0.43	-51.16	1.19	2.06	-42.23
Total New Supply	214.85	208.26	3.16	836.59	783.20	6.82
Stock Change	9.61	15.39	–	38.90	36.66	–

Totals may not add due to rounding

Sources: U.S. Department of Energy
National Coal Association
Chase Manhattan Bank

EUROPEAN ECONOMIC COMMUNITY COAL BALANCES – HARD COAL

	----OCT. THRU DEC.----			----CALENDAR YR.----		
	1980	1979	CHANGE	1980	1979	CHANGE
	Million Short Tons		-%-	Million Short Tons		-%-
Deliveries to:						
Electric Utilities	51.89	51.27	1.21	197.45	183.37	7.68
Coke Plants	23.31	25.27	- 7.76	96.86	96.59	0.28
General Industry	7.09	6.75	5.04	25.36	25.03	1.32
Retail Deliveries	5.46	5.95	- 8.24	19.66	21.90	-10.23
Total Domestic Demand	87.74	89.24	- 1.68	339.33	326.87	3.81
Exports	0.25	0.35	-28.52	0.95	1.97	-51.78
Total Demand	88.00	89.60	- 1.79	340.27	328.87	3.47
Supply						
Domestic Production	70.52	67.86	3.92	272.01	263.10	3.39
Imports (Third-Party Countries)	19.07	19.89	- 4.12	80.65	65.20	23.70
Total New Supply	89.59	87.75	2.10	352.66	328.31	7.42
Stock Change	1.59	-1.85	–	12.37	- 0.56	–

Totals may not add due to rounding

Sources: Eurostat
Chase Manhattan Bank